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TITLE: Vehicle communication and remote control system

Drawing Description Text (61):
FIG. 57 is an electrical schematic diagram of an integrated vehicle systems controller constructed in accordance with another embodiment of the present invention; and

Drawing Description Text (62):
FIGS. 58A and 58B are flow diagrams illustrating the flow of operations utilizing the integrated vehicle systems controller shown in FIG. 57.

Detailed Description Text (132):
Preferably, the vehicle electrical control system for performing the above functions is that described above and shown in FIGS. 3 or 5. An alternative vehicle electrical control system 730, is shown in FIGS. 44 and 45, and include, as shown in FIG. 44, a microcontroller 735 such as a Motorola MC68HC05, which receives demodulated signals from the receiver 724 shown enclosed within dotted lines in FIG. 44 via a data bus 727. The receiver 724 may be the receiving portion of the two-way pager module described above or the receiving portion of cellular transceiver 70 (FIG. 5), but may alternatively be a typical duo-conversion receiver having first and second local oscillators 721 and 723, appropriate bandpass filters and amplifiers, and a demodulator circuit 725 which provides digital data output on a data bus 727 to an input of microcontroller 735. Microcontroller 735 includes an integral non-volatile memory for retaining data when the vehicle is not in operation. In vehicles including a single wire multiplex bus 742, an output terminal 743 of microcontroller 735 is coupled to the input of a multiplex communication circuit 744 comprising a 728 pin integrated circuit which is coupled by output conductor 747 to a single wire data bus 742. The average data rate for the multiplex circuit 744 is 10.4 kilobits per second. Microcontroller 735 communicates with circuit 744 through its SPI serial interface port 743. When circuit 744 receives a message over the bus 742, it interrupts the microprocessor, which in turn initiates communication with the circuit through its SPI port. Microprocessor 735 then reads the data from the SPI register and acts upon the information. The multiplexing scheme is set forth in SAE standard J1850 and is universally used in the automotive industry.

Detailed Description Text (153):
In addition to those inputs to microcontroller 735 or microcontroller 770 as shown in FIGS. 44, 45, and 47, respectively, various other input signals may be provided including input signals from the following: each of the window switches; a circuit for detecting whether a key is in the ignition; a speedometer; an RPM detecting circuit; a battery voltage detecting circuit; a fuel level sensor; the turn signal circuit; ambient light sensors; a reverse gear switch input; a drive gear switch input; a park gear switch input; a rain sensor; an interior thermometer; an exterior thermometer; an engine temperature sensor; an oil pressure sensor; a rear defrost switch; door open/closed sensors; a driver's exterior door lock sensing circuit; and a headlight switch. As will be apparent from the following description

of the operation of the foregoing system, microcontroller 735 and microcontroller 770 utilize various combinations of these input signals to control the various vehicle accessories associated with the control modules connected to multiplex bus 742 in a manner defined by a control program stored in a non-volatile memory of the respective microcontroller.

Detailed Description Text (156):
Referring to FIG. 48A during system initialization, microcontroller 735 begins the execution of the main control program by clearing its RAM, recalling the last user ID by reading the same from the non-volatile memory, and reading a flag table associated with the last ID (step 1201). Initially, the associated flag table may be set in the factory or by the dealer to specify default values. As described below, the flags in the flag table may subsequently be modified by a reprogramming signal included in either a paging signal or a cellular RF control signal having the vehicle's ID.

Detailed Description Text (167):
A first vehicle accessory that may be initialized is the position of the driver's seat. Thus, if the driver with the new ID has selected the last seat position memory feature, microcontroller 735 will determine in step 1225 that the associated flag has been set and will set the seat position to that last used by the driver with the new ID by reading seat positioning parameters stored in non-volatile memory the last time this driver used the vehicle (step 1227). Next, microcontroller 735 will check whether a flag is set for a last mirror position feature (step 1229) which, if selected, causes microcontroller 735 to set the mirror positions to that last used by the driver with the new ID (step 1231). If this flag is not set, the routine for setting the mirror positions is dormant with respect to the driver with the newly detected ID.

Detailed Description Text (169):
In step 1237 (FIG. 48C) microcontroller 735 determines whether the vehicle ignition is on. If the vehicle ignition is not on, microcontroller 735 advances to step 1281 in FIG. 48F and skips the remaining portion of the new user initialization routine. If the ignition is on, microcontroller 735 proceeds in step 1239 to determine whether a flag has been set for a last temperature setting feature. If the flag has been set for this feature, microcontroller 735 will set the interior temperature for the climate control system to that last used by the driver with the new ID by retrieving the last used temperature setting from the non-volatile memory (step 1241).

Detailed Description Text (206):
Next, microcontroller 735 checks whether a turn signal is on (step 1401) and checks the flags for features associated with the turn signal. The first feature that may be selected increases the volume of a chime associated with the turn signal as the time the turn signal is on increases. Thus, if the associated flag is set for this feature (step 1403), microcontroller 735 will increase the volume of the chime as the length of time that the turn signal is on increases in order to alert the driver if the turn signal did not turn off following a turn or lane change. If the flag is not set for this feature, microcontroller 735 will check whether a flag is set for a feature which activates a chime after a turn signal has flashed twenty times without a steering wheel correction being made (step 1407). If this flag is set, microcontroller 735 will count the number of times the turn signal has flashed and will activate a chime after twenty flashes without a steering wheel correction being made (step 1409).

Detailed Description Text (211):
The integrated vehicle systems controller constructed in accordance with this alternative embodiment of the present invention includes an RF receiver or transceiver module 1817 coupled to an antenna 1815 for receiving RF signals sent over a telephone 1820 via a transmitter station 1825, and for transmitting signals

back to the transmitter station 1825 provided the receiver module is a two-way transceiver. Receiver module 1817 may be coupled to a microprocessor 1830 via an interface board 1835 for sending received RF messages to microprocessor 1830. A trainable transmitter 1840 is coupled to receiver module 1817 and microprocessor 1830 via interface board 1835. Thus, when an RF control signal is received by receiver module 1817, instructing the system to lock or unlock the doors, microprocessor 1830 sends a control signal to trainable transmitter 1840 causing it to transmit a control signal having learned characteristics via antenna 1845 to an antenna 1850 of a RKE receiver/actuator 1855. When RKE receiver/actuator 1855 receives this control signal, it unlocks or locks the vehicle's doors in accordance with the control signal in the same manner that it would operate when receiving the control signal from a key fob transmitter 1857.

Detailed Description Text (212):
Trainable transmitter 1840 preferably is constructed in accordance with the teachings of U.S. Pat. No. 5,661,804 entitled TRAINABLE TRANSMITTER CAPABLE OF LEARNING VARIABLE CODES, filed on Jun. 27, 1995, the disclosure of which is incorporated herein by reference. Alternatively, trainable transmitter 1840 may be the trainable transmitter disclosed in U.S. Pat. No. 5,442,340, U.S. Pat. No. 4,479,155, or U.S. Pat. No. 5,475,366, the disclosures of which are incorporated herein by reference. Because the trainable transmitter may be used to learn and transmit RF signals to garage door openers, gates, house light modules, house appliances, and any RF actuated door locks, the integrated vehicle system's controller may be used to remotely close or open a garage door or turn lights on or off in response to an RF cellular or paging signal, provided the vehicle is parked in the near vicinity of these devices.

Detailed Description Text (213):
As shown in FIG. 57, the integrated vehicle system's controller 1810 may further include a display 1882 for displaying received messages, a GPS module 1884 connected to a GPS antenna 1886 and to interface board 1835, a compass/temperature circuit 1888, which may optionally include its own display 1890. Integrated vehicle systems controller 1810 may optionally include a vehicle system bus interface 1892 to couple the device other vehicle accessories and devices 1894 coupled to the vehicle system bus. Optionally, microprocessor 1830 may be eliminated by programming the microprocessor in the trainable transmitter 1840 to perform the functions recited above in the preceding sections.

Detailed Description Text (215):
The integrated vehicle systems controller circuit 1810 may be mounted in a rearview mirror, sun visor, overhead console, or other accessory. As such, the integrated vehicle systems controller 1810 may be sold as an after-market device and allow for the remote locking and unlocking of the vehicle's doors using an RF signal provided the vehicle is equipped with an RKE receiver.

Detailed Description Text (217):
The process begins in step 1902, when a user dials the service control center to request, for example, that the vehicle's doors be unlocked. The control center would first authenticate the user's identity (step 1904) and the user would subsequently select the vehicle to which the RF signal is to be transmitted through a dialing sequence (step 1906). Then, the user selects a directive (i.e., unlocking the vehicle's doors) through a dialing sequence in step 1908. The control center then sends the directive to the vehicle (step 1910) via the transmitting station 1825. Upon receiving this RF control signal, the integrated vehicle systems controller 1810 would transmit back an acknowledgement that the RF control signal was received (steps 1912 and 1918). If, on the other hand, the integrated vehicle systems controller did not receive the RF control signal and no acknowledgement is received by the control center between a predetermined time period, the control center will retry to transmit the control signal in step 1910 provided that it is a first attempt to retry to transmit the signal (step 1914). If the control center

unsuccessfully attempts to transmit the RF control signal more than twice, the control signal will send an error signal indicating that no acknowledgement was received to the user (step 1916). Also, if the integrated vehicle system controller 1810 sends the acknowledgement to the control center, but the center does not receive the acknowledgement (step 1920), the control center will retransmit the control signal to the vehicle. After transmitting an acknowledgement to the control center, the integrated vehicle system controller 1810 sends a directive to the device actuator 1855 (step 1922). If the actuator 1855 receives the directive (step 1924), the device actuator sends an acknowledgement back to the integrated vehicle system controller 1810 (step 1930). If the actuator does not receive the directive or if the acknowledgment is not received by the integrated vehicle system controller, the integrated vehicle system controller will attempt to retransmit the directive (step 1922) provided it has not already attempted to retransmit the directive (step 1926). If, after a second attempt, the actuator device does not receive the directive or an acknowledgement is not received back from the actuator device, the integrated vehicle system controller sends the signal back to the control center informing the control center that an acknowledgement had not been received (step 1928).

Detailed Description Text (218):
If the actuator device receives the directive and selectively sends the acknowledgement back to the integrated vehicle system controller, the actuator attempts to perform the directive (step 1938), and if successful (step 1940), the actuator sends a second acknowledgment signal back to the integrated vehicle system controller (step 1946). If the actuator device is unsuccessful in performing the directive, it will reattempt to perform it (step 1938) provided it is only the second attempt to do so (step 1942). If it is subsequently unsuccessful in performing the directed function, the actuator transmits a signal to the integrated vehicle system controller representative of this fact whereby the integrated vehicle system controller then sends a signal to the control center indicating that no acknowledgement has been received. If, following step 1946, the integrated vehicle system controller does not receive a second acknowledgement from the actuator that it performed its function (step 1948), the actuator will attempt to resend the acknowledgement to the integrated vehicle system controller in step 1946 provided it is only its second attempt to do so (step 1950). Again, if it is unsuccessful in transmitting this acknowledgment to the integrated vehicle system controller, the end user is informed that an error occurred in step 1952.

Detailed Description Text (219):
If the integrated vehicle system controller receives the second acknowledgement that the actuator device successfully performed the directed function, it sends the acknowledgement to the control center (step 1954). If the control center does not receive this acknowledgement signal (step 1956), the integrated vehicle system controller will again send the acknowledgement to the control center (step 1954) provided it is not its second attempt to do so (step 1958). If the control center does not receive an acknowledgement within a predetermined time period, it notifies the end user that an error has occurred (step 1960). On the other hand, if the control center receives this acknowledgement signal (step 1956), the control center sends an acknowledgement to the user (step 1962) which the user may then acknowledge receiving. If the user does not acknowledge receiving this acknowledgement (step 1964) the control center will resend the acknowledgement to the user provided as a first attempt to do so (step 1966), otherwise it may send an error signal to the user (step 1968).